SOME REMARKS

ABOUT A

Common Functional Eye Trouble.

By JOSEPH A. WHITE, M. D,

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Read before the Medical Society of Va. at its Annual Session at Danville, 1880.

Mr. President and Gentlemen:—In selecting as the subject of a paper the common trouble of *weak eyes*, or asthenopia, as it is technically called, I trust I will not be imposing on the good nature of this assemblage by a rehash of a worn-out topic. My excuse for this paper is the large percentage of cases of this trouble I have met with during the past year in my practice, thinking that perhaps a few remarks on their symptoms, causations, etc., might help some of my professional brethren to recognize such when they encounter them, and take proper measures to discover the cause and give relief.

Symptoms.—Such patients complain that they cannot use their eyes for any length of time without discomfort, that the print becomes blurred and indistinct, and that in spite of every care and prolonged rest of the eyes, they do not seem to improve. With some, any continuous effort at reading, writing or close work of any kind causes, not only discomfort in the eyes and blurred vision, but also pain in the forehead, with occasionally vertigo, nausea and vomiting. Sometimes with or without these latter symptoms, we see blood-shot eyes, red eyelids, and intolerance of bright light—particularly artificial light—showing irritation of the deeper structures of the eye, the retina and nerve.

Usually such cases have suffered some time before applying for relief; and when they do so, the usual treatment is some slight astringent, tonics and the advice to rest the eyes, under the impression that impaired health or overwork is the cause. After some continuance of this treatment, the patient recommences the use of the eyes only to find they are in a short time as badly off as before.

Both patient and physician are thus frequently discouraged, and in consequence, the old idea that asthenopia was incurable has not yet been entirely done away with. During the past year I have been consulted by 87 cases of asthenopia; 84 at my private office among 296 eye patients, and 3 at the Richmond Eye, Ear and Throat Dispensary among 270 eye patients; a percentage in private practice of nearly 28 per cent., and in dispensary work of only a little over 3 per cent.—figures which seem to demonstrate the almost perfect immunity of the lower classes against such troubles. *Asthenopia* would seem, therefore, to belong to educated people, and especially to those who use their eyes much in reading, writing, close study, etc.

Only one watchmaker, one printer, and three sewing women were in the above number of 87; the balance being school children, students, teachers, book-keepers and professional men and studious women.

The ages of these patients ranged from 7 to 67 years of age; two were under 10 years; thirty between 10 and 20; twenty-six between 20 and 30; eighteen between 30 and 40; eleven over 40. These figures would indicate a greater tendency to asthenopia during school and college life than afterwards, fifty-eight being under 30 years of age, and thirty-two under 20.

This disorder of weak eyes or asthenopia is, as a rule, due to some impairment of the normal relations between two very important functions of the eye, which must work in perfect accord to allow of comfortable vision, viz., the accommodation and the convergence—the *accommodation* being the power the eye possesses of changing its focus for different distances; the *convergence*, the ability to keep both visual axes fixed upon the object accommodated for. Any disturbance in the normal relations of these two muscular functions will result in fatigue of the eyes with symptoms of asthenopia, from feebleness of the function that is wanting in power.

The eye is a hollow globe or sphere, lined posteriorly by the retina, which receives the image of the object looked at. The axis of this sphere from apex of cornea to retina is about eleven lines. The interior of the eye is filled by what is called the *dioptric apparatus*, made up of the refractive media, viz., the cornea, aqueous humor, lens, and vitreous humor, which form the image on the retina by bringing the rays from the object to an exact focus at the back of the eyes. The focus of this dioptric apparatus is usually fixed for the farthest point of distinct vision, viz., *infinity* when the eye is in repose. *Infinity* is any point at or beyond which any object being

placed, the rays from that object will fall parallel to each other on the eye.

Hence, when an eye has its retina situated at the focus of its dioptric apparatus, or if its farthest point of distinct vision when in repose is at infinity, we call it a normal or *emmetropic eye*, and this is what is meant by the "state of refraction" of the eye. When such an eye looks at any object closer than infinity, or when the rays from the object fall upon the eyes no longer parallel but diverging from one another, it can no longer remain in repose; it must become active, and change its focus to increase its refraction, so that the object will still be imaged upon the retina. In other words, it must accommodate itself and its focus to the distance of the object; and this it does in altering the convexity of the crystalline lens by contracting the ciliary muscle which surrounds the lens; and this power is what is meant by the *accommodation*.

In doing this, as the object approaches the eye, the eyes *converge* more and more towards each other, keeping pace with the accommodation until the nearest point is reached at which distinct vision is possible. The distance between this nearest point and the farthest point of vision represents the *range* of the accommodation, and the convergence must work all the time in unison with the latter, as both functions are called upon for an equal amount of labor.

The convergence is performed by the internal straight muscles of the eyeball, just as accommodation is performed by the ciliary muscle.

Asthenopia, then, is impairment of muscular action in one or other of these muscles, or is a disturbance of the normal relations between the internal recti and the ciliary muscle.

Either or both of these agents may be at fault in producing the weak eyes complained of, and this can result from different causes.

Causes.—General bodily weakness or want of tone about the whole muscular and nervous systems can produce it, as we see after typhoid fever, confinement, diphtheria, etc. Various nervous disorders can cause it by their direct or reflex action upon these muscles, as in brain or spinal, and in uterine troubles. But the most frequent cause is to be found *in errors of refraction*, which are deviations from the standard taken for a normal or emmetropic eye.

When the disordered visual function is due to trouble of the ciliary muscle, it is called *accommodative asthenopia;* when to trouble of the internal recti, *muscular asthenopia.*

In most cases it is easy to determine where the fault lies; in some it is exceedingly difficult to say to which side lies the preponderance of power. We frequently meet with cases where the most careful examination of the eye gives only negative results. We find nothing at fault. Every part of the eye seems to do its work, there is no apparent change, and still the pa-

tient gives the history of asthenopia. These are obscure cases due to some reflex nerve influence—in men, difficult to locate; in women, generally due to some uterine disorder. This form has been called *hysterical kopiopia, neurasthenic asthenopia*, etc. It simulates very closely accommodative asthenopia due to long sight (*hyperopia*), but there is no long sight, and no improvement from convex glasses.

Its symptoms, according to Abadie, Förstler, Freund, Swanzy and others, are as follows: Visual disturbance, dull periodic pains in eyes, radiating sometimes to nose, forehead and cheek, some intolerance of bright light and lachrymation; these phenomena are irregularly excited by fatigue, moral emotions, work, bright light, etc. Sometimes a point sensitive to pressure is found over the last cervical or first dorsal pair of nerves. The uterine troubles that produce it are chronic metritis, ulcers of the neck, uterine and vaginal catarrh, displacements and difficult or arrested menstruation. The eye trouble seems to be a reflex disorder similar to derangements of the stomach met with in uterine diseases. But such subjects are rare compared to those due to errors of refraction.

I will briefly mention these deviations from the standard given for a normal or emmetropic eye, which we have defined as one which has its retina situated exactly at the focus of its dioptric or refractive apparatus when in a state of repose; or in other words, whose farthest point of distinct vision is at infinity: 1st. When the focus of the dioptric apparatus is *behind* instead of at the retina, from the eyeball being too short—less than 11 lines—in its antero-posterior axis, or from the dioptric apparatus being of lower refractive power than normal, we have *hyperopia* or longsightedness. Such an eye in a state of repose no longer sees objects clearly at infinity, but requires the aid of its accommodation to increase its refraction, so as to compensate for its defect, rendering the rays from the object convergent instead of parallel, and thereby bringing the object to a focus on the retina, which is inside the normal focus. The eye is therefore in constant action even when normal eyes are in repose, and the ciliary muscle has more than its usual share of work to perform. A convex glass of sufficient focal length to compensate for the defect in the refraction will relieve the muscle of this extra work, and focus distant objects on the retina.

2d. When the focus of the *dioptric apparatus* is in front of the retina from the eyeball being too long, and from the dioptric system being of higher refractive power than normal, we have nearsightedness or *myopia*. Such an eye cannot, like the long-sighted eye, correct its defect by its accommodation, because the latter is already relaxed to its uttermost when in repose; and it therefore can only bring objects at infinity to a focus on its retina by means of a concave glass, which renders the rays more divergent, and gives the dioptric system a longer focus.

3d. When the dioptric system has a different focus for different meridians, or when the radii of the curvatures of any of its refractive media differ, we have what is called *astigmatism*—an irregularity in the refraction due to these deviations from a spherical form.

Hyperopia, or long-sight, is a common congenital defect, due probably to an arrest of development of the eyeball; it may, however, afterwards change to emmetropia or normal, or even to myopia or nearsightedness.

The latter (*myopia*), is usually due to disease and softening of the coats of the eye, causing elongation of the eyeball, except in a small minority of cases due to increased refraction without elongation, to which probably the so-called second sight of old people is to be attributed. Consequently, nearly all near-sighted eyes are diseased organs, contrary to the popular ideas on this subject. *Astigmatism*, or irregular refraction, is usually congenital, though often acquired; and, in fact, very few eyes are altogether free from it, though it is, as a rule, not sufficiently marked to be annoying and require correction. In the 87 cases of asthenopia I have collected, 69 were accommodative asthenopia, or weak accommodation, 18 muscular asthenopia, or impaired convergence. In the 69 cases of accommodative asthenopia, the causes were as follows:

In 36 cases, hyperopia or long-sight equal in both eyes.
In 8 cases, astigmatism equal in both eyes.
In 13 cases, the refraction was different in the two eyes.
Of these, in 1 case, one eye was hyperopic, the other myopic.
In 2 cases, one eye was hyperopic, the other astigmatic.
In 2 cases, one eye was hyperopic, the other emmetropia.
In 1 case, one eye was myopic, the other astigmatic.
In 1 case, one eye was myopic, the other emmetropia.
In 5 cases, myopia different in both eyes.
In 1 case, hyperopia different in both eyes.
12 cases were emmetropic or normal in refraction.
Of these, 2 had spasm of accommodation with simulated myopia.
1 paresis of accommodation from diphtheria.
1 paresis of accomodation from debility after pneumonia.
2 paresis of accommodation from debility after confinement.
6, no assignable cause except hysterical asthenopia.

Seven of the cases of hyperopia had spasm of accommodation, causing *an apparent myopia*, instead of *hyperopia*. Six cases had periodic internal squint, and one suffered from diplopia, or double vision. Of the 18 cases of muscular asthenopia, I found—

In 8 cases myopia, or short-sight.
In 6 cases hyperopia, or long-sight.
In 2 cases emmetropia—no assignable cause for the weak convergence.
In 2 cases astigmatism unequal in both eyes.

Six of these cases were annoyed by double vision, and two had external squint.

The *complications* in the above cases, besides the spasm of accommodation, the internal and external squint, and the diplopia already mentioned, were blepharitis or inflamed eye lids in twenty-five, conjunctivitis in fourteen, and retinal congestion in eighteen cases. Thus we see, that in all but fourteen of the eighty-seven cases, some error of refraction was the active agent in disturbing the relations between the accommodation and convergence, and causing a want of harmony by necessitating abnormal work on the part of one or other of these functions. In the other fourteen, the trouble was due to deficient power in the ciliary or internal recti muscles, from various causes.

Hyperopia, or *long-sightedness*, given above as the most frequent cause of accommodative asthenopia—in thirty-six out of sixty-nine cases—produces this result by the constant and excessive demand it makes upon the ciliary muscle. As such eyes require an *effort* of the accommodation to focus distant objects upon the retina, unless the defect has been corrected by suitable glasses, their accommodation is overweighted or overstrained by *just the amount of the effort made for distance* when they are called upon for near vision; for, when accommodating for a near object, the ciliary muscle not only makes the *usual effort* made by the normal or emmetropic eye to focus that object, but also the *additional effort* required to overcome the defect of refraction. Hence, the muscle is handicapped or overweighted, and breaks down, with resulting symptoms of asthenopia.

The following case will exemplify this:

Case 1.—"E. W., a young girl, eleven years of age, was brought to me by a physician in Richmond one year ago. Has had weak eyes some months. Cannot study her lessons without her eyes becoming painful and watery. Bright light—especially gas light—very annoying. Has frequent headaches, with nausea and vomiting. Her mother noticed they came on nearly always after prolonged application to her books. Eyes never red or inflamed; but are perfectly clear and normal in appearance. Vision was $\frac{20}{20}$—both eyes equal to the normal standard of perfect vision. Neither convex nor concave glasses improve it. Range of accommodation and convergence normal. As the history pointed to accommodative asthenopia, probably from long sight, I ordered a one per cent. solution of atropiæ sulphatis to be dropped in the eyes twice a day. Three days after, the examination of the eyes showed that $\frac{20}{20}$, or normal distant vision, could only be obtained by using a thirty-inch convex glass; this proved the trouble to be as I suspected—due to a hyperopia of $\frac{1}{30}$, which required a thirty-inch convex glass to correct it, and which heretofore she had hidden in correcting it by her accommodation. Here eyes, plus the glass were equal to emmetropic,

eyes; without it the ciliary muscles were overtaxed just the amount of the glass whenever she attempted near vision; and this overtaxing of the muscles showed itself in the above symptoms. I ordered No. 30 to be worn constantly, and though at first irksome and annoying to the child, she soon accustomed herself to the spectacles, and was enabled to prosecute her studies without any return of the eye trouble or sick headache."

Sometimes, as in six of these cases, the convergence, in its effort to keep pace with the overworked accommodation (both being supplied by the third pair, and receiving the same amount of innervation), gives way first, and muscular asthenopia results, when prisms, either alone with their bases in, or in combination with a convex glass, generally do away with the discomfort; or, on the other hand, spasmodic contraction of the internal recti from the excessive innervation takes place, producing periodic internal squint, with or without diplopia, as in the following case:

CASE II.—"S. B., a young girl 11 years of age, who has suffered from weak eyes since she first began to go to school, was brought to my office last November. Difficulty of studying, especially by artificial light; eyes begin to ache, and she is obliged to suspend her work. At times left eye rolls in, and she looks quite cross-eyed. Has red lids and some conjunctivitis. Some months before, had been under Dr. Knapp's care in New York, who had ordered $+\frac{1}{14}$ (14-inch convex glass) to be worn constantly. Had not followed his advice, and in consequence eyes still gave trouble. Vision was $\frac{20}{30}$; a 36-inch convex glass improves vision; a 24 makes it worse. Diagnosis—accommodative asthenopia, with periodic squint, from hyperopia or longsight. Finding by the ophthalmoscope that $+\frac{1}{36}$ did not represent all the hyperopia, the greater part of it being latent or masked by her accommodation, I ordered a one per cent. solution of sulphate of atropia, to be used twice daily for several days, in order to thoroughly paralyze the ciliary muscle and reveal all the defective refraction. The examination then showed her hyperopia to be $\frac{1}{8}$; or, according to the new metrical system, 4.9 dioptrics; and more than $\frac{3}{4}$ of the defect was therefore corrected by her accommodation. The consequent strain upon the latter caused it to give trouble in close work, and the extra innervation of the internal recti caused the tendency to internal squint. I ordered her to resume the No. 14 given by Dr. Knapp, and wear them constantly until she could see better with them than without them, and then to change to No. 9 (or a 9-inch convex), to be in turn worn constantly. At present she is wearing No. 9 with comfort, and the consequent relief to her accommodation and convergence has done away with the tendency to strabismus; the blepharitis has disappeared and she can study without trouble."

This case also calls your attention to the fact that internal strabismus results from hyperopia. In fact, nearly all cases of internal squint are

attributable to this defect of refraction. Therefore cases of periodic squint can be cured by relaxing the accommodation by atropia, and correcting the defect of refraction, and in confirmed cases no operation should be performed without also correcting the hyperopia.

Astigmatism, or irregular refraction, causes asthenopia by the constant variation and irregularity of the demand upon the ciliary muscle to accommodate the eye for different objects or different parts of the same object in different meridians, which I will also exemplify by a case in point.

CASE III.—"Miss E. S., 12 years of age, suffers with pain in eyes whenever she applies herself to her studies, with the other manifestations of accommodative asthenopia, at times internal squint. V=$\frac{20}{50}$. I thought her longsighted, but spherical convex glasses gave very little improvement. I used atropia to paralyze accommodation, and found vision decrease to $\frac{6}{100}$. I tested her eyes for astigmatism, and discovered that with convex 16, she could see horizontal lines distinctly, but not vertical lines; while with convex 8 ($+\frac{1}{8}$), she could see vertical lines and not the horizontal ones. She therefore had hyperopic or longsighted astigmamatism—the hyperopia being twice as great in the horizontal as in the vertical meridian. The proper glass to correct her defect of refraction was one that would correct the defect common to both meridians, viz.: a spherical glass of 16-inch focus, as she had a hyperopia of $\frac{1}{16}$ in each meridian; but in addition to this she required another correction of the additional hyperopia in the horizontal meridian so as to equalize the refraction of the eye, and make both meridians alike. This would have been accomplished by giving in combination with the ordinary convex $\frac{1}{16}$ a cylindrical convex lens of 16-inch focus, with its axis vertical; its axis being a plane surface without refractive power. This would increase the refraction in the horizontal meridian, and not alter it in the vertical meridian. The formula for such a glass is $+\frac{1}{16}$s.$+\frac{1}{16}$c., axis 90°. Instead, however, of giving her the combined spherical and cylindrical lens, I only ordered the cylindrical lens $\frac{1}{16}$, with its axis vertical $\frac{1}{1}$ c., axis 90°, leaving the uniform hyperopia without correction, resolving if she still had trouble to give the compound glasses. Up to this time, nearly a year after, she has had no return of the asthenopia or of the squint. Here, then, I only equalized the refraction and took away the irregular and variable demand upon the ciliary muscle."

Another of the causes given as productive of accommodative asthenopia is *unequal refraction in the two eyes*, which necessitates an unequal demand upon the accommodation of the two eyes, as they each require a different focus, and in the effort to work in unison, gradually impair one or other of these muscular functions of accommodation and convergence. For instance:

CASE IV.—"W. H. B., printer, 34 years of age, who has a great deal of reading to do in correcting proof-sheets, reading manuscripts, etc., complained that for some years his eyes had given him trouble, so as at times to incapacitate him for work. His eyelids were always red, and eyes became bloodshot on the slightest use, with feeling of burning, itching, and intolerance of light. Examination of the refraction of the eye showed *right eye* hyperopic or longsighted in a slight degree, requiring a 48-inch convex glass to correct the defect; and *left eye* hyperopic astigmatism or longsightedness of different degrees in the different meridians—in the vertical meridian $\frac{1}{36}$, and in the horizontal meridian $\frac{1}{18}$, or double what it was in the vertical. This eye, therefore, required a spherical 36 inch convex combined with a cylinder, also 36-inch convex with its axis vertical. Vision with these glasses, was then normal and equal in both eyes. A few weeks after getting his glasses, his red lids, inflamed eyes and discomfort in work had disappeared—merely from correcting the errors of refraction and equalizing the latter in both eyes."

Another such case:

CASE V.—"A. Y., 11 years of age, has suffered with his eyes since he began to go to school. They became red and inflamed, with pain, and letters are blurred. Vision equal to $\frac{20}{200}$ left; $\frac{20}{80}$ right. Reads Jaeger No. 1 at four inches. A concave glass No. 15 makes vision on the left $\frac{20}{20}$, or normal. A concave No. 30 makes right $\frac{20}{20}$. With these glasses he reads Jaeger No. 1 at 12 inches."—evidently myopia or nearsightedness, differing in the two eyes. Neither of parents nearsighted, but his father, who is emmetropic, has suffered from weak convergence, and now, at 42 years of age ,is troubled with diplopia or double vision from right eye rolling out. His vision for distance is normal, and can read with comfort because he has no power of fusion, and sacrifices binocular vision. The boy has no trouble with his convergence. Ordered the glasses as above to be worn, and his symptoms of asthenopia disappeared."

Both the above cases had accommodative asthenopia, due to the difference in the refraction of the two eyes, which were in consequence unequally taxed.

Again: In either hyperopic (longsighted), or in emmetropic (normal) eyes, the ciliary muscle, from constant use in near vision, can get into a state of constant contraction, or a spasmodic condition which increases the refraction so as to produce an apparent myopia or nearsightedness, with resulting symptoms similar to those of accommodative asthenopia.

CASE VI.—"C. A., civil engineer, 23 years of age, has had discomfort of eyes for some weeks. Decided pain when he attempts to work. Conjunctivitis, intolerance of light and lachrymation—one point in each eye, just over insertion of external rectus, especially painful. His father is very myopic. Is himself slightly so, he thinks. Vision was—left eye, $\frac{18}{25}$; right

eye, $\frac{1}{4}\frac{8}{5}$. Concave 48 ($\frac{1}{48}$) gives left $\frac{1}{1}\frac{8}{8}$; concave 24 ($\frac{1}{24}$) right $\frac{1}{1}\frac{8}{8}$. Retina cloudy, and optic nerve congested. Ordered solution of boracic acid locally. *Diagnosed*—accommdative asthenopia from unequal refraction in the two eyes, and ordered concave glasses to correct defect. Had to go to Baltimore on business, and whilst there consulted another oculist, who made very nearly the same diagnosis. He got his glasses and was seemingly relieved. A short while after, he returned to me with the symptoms intensified and myopia increased. Ordered atropia to be used locally. A week later tested the eyes and found concave glasses no longer improved vision, that he required a $+\frac{1}{24}$ (24-inch convex) for the left eye, and a $+\frac{1}{4}\frac{1}{8}$ (48-inch convex) for the right eye, to restore normal distant vision. My error in diagnosis was made apparent by this discovery of hyperopia where previously had existed a simulated myopia, evidently the result of spasm of the ciliary muscle. By continuous atropinization for some weeks, and use of convex glasses, the symptoms gradually subsided and have not returned."

But this condition is very different from that of real myopia, due usually to elongation of the eyeball from disease of the deeper structures, which is a common cause of weak eyes, apart from its intrinsic disease, by producing muscular asthenopia or weak convergence, the demand upon the internal recti in converging such an elongated globe being beyond their power, and resulting in divergence of one of the eyes, instead of being fixed with its fellow upon the object; and sometimes either periodic or permanent external strabismus follows. When the deviation of the eye is constant, operation is very frequently called for because of the deformity of the double vision, but often this divergence is only just sufficient to cause disordered vision; without being itself apparent either to patient or physician, the cause of the eye trouble being attributed to something else, as in the following case:

Case VII.—"A well-known gentleman of the legal profession of Richmond, 46 years of age, applied to me to know how long his optic nerves would serve him. He had been told by a distinguished medical gentleman, who had carefully examined his eyes with the ophthalmoscope, that he had chronic inflammation of the optic nerve, with probable tendency to hemorrhage. For several years he had a constant mist before his eyes when reading, and if he continued work long, it would be followed by acute pain in the eyes and inability to go on with his work. He was quite nearsighted, but had been advised not to use his glasses except when he absolutely needed them for distance. The treatment he had followed was directed to the control of his optic nerve disease, and he had been forbidden to use his eyes much. The ophthalmoscope showed his retina and disk quite congested; his myopia was $\frac{1}{7}$, or about 5 dioptrics, requiring a concave No. 7 to correct it, and his vision with his glasses was $\frac{2}{2}\frac{0}{0}$. A further examination revealed the cause of his trouble to be some impair-

ment of his convergence power, due to the strain upon his internal recti when using the eyes at close work; he had muscular asthenopia. To this was attributable the mist before his eyes, his inability to read, and his fear of future blindness. A pair of concave glasses, to move his reading point to about 12 or 14 inches from his eyes, so as to relieve his internal recti by lessening the convergence, were ordered for constant use; and a similar pair, ground on weak prisms to exercise these muscles occasionally, effected a cure in a short time."

This case shows how one of the symptoms of this trouble, viz.: the retinal congestion, can be deceiving to the physician who uses the ophthalmoscope, and lead him to look for further signs of optic nerve disease and impending brain trouble, with consequent misdirected treatment.

Asthenopia, then, in both its forms, is attributable to impaired and unnatural muscular action of the ciliary and internal recti muscles, consequent upon *defective refraction*. From this results fatigue, which produces active congestion whilst the effort is kept up, and is followed by passive congestion, from which we have the red lids, the inflamed conjunctiva, and the congested nerve and retina. We will frequently find that cases of blepharitis and conjunctivitis that have persistently resisted treatment, or constantly recurred, are the results of asthenopia. The treatment of this trouble should always be directed to harmonizing the accommodation and convergence by correcting any error of refraction with suitable glasses, so that the ciliary and internal recti muscles will work in unison. This, in a majority of instances, will effect a cure; but we sometimes meet cases where this is not sufficient, and we must train such eyes by judicious exercise until they recover their working power. The usual prescription of physicians with these patients is *rest* for the eyes and tonics internally. The tonics are often an important element in the treatment, especially in certain cases of debility; but rest is the most pernicious advice that could be given. A muscle which fails in its work for want of proper and well regulated exercise, will not become normal in action by doing nothing. All muscles are better off, and become more useful servants, by being properly and regularly trained without overtaxing them. As long as the *rest* is kept up there is no discomfort, but as soon as the muscle is put to work again, discomfort and the evils that first manifested themselves recur. Many a young man, ambitious to study, has been debarred from a collegiate education by this mistaken advice; numbers desirous of devoting themselves to some profession to which their inclinations and talents led them, have been condemned to a farm life or other uncongenial occupation. Horace Greeley's advice, "Go west, young man," has been given again and again to such patients by their attendant physicians, when the proper treatment would have enabled them to pursue their studies.

With your permission I will refer to one more case which exemplifies

these remarks, and shows the mode of properly exercising the eye when the correction of the error of refraction fails to effect a cure.

Case VIII.—"A. M. S., a young man 22 years of age, applied for treatment in February last. Two years ago, in consequence of weak eyes, he was obliged to discontinue the study of law and go to farming by the advice of his physician. He has no enjoyment from books, though fond of reading; cannot read ten minutes without his eyes becoming inflamed and painful. Vision was $\frac{1}{8}$—better than the average. Very slight insufficiency in convergence. Retina and optic nerve markedly congested. Atropine mydriasis showed very low degree of hyperopia, equal to $+\frac{1}{48}$, or a 48-inch convex glass. I gave him this glass to use, advised abstinence from reading by artificial light, and ordered strychniæ sulphas, $\frac{1}{20}$ grain, *ter die*, internally. He returned in April with no improvement. As he said he had been more comfortable when using atropia locally, I tried atropine mydriasis for six weeks or more, allowing him to read with a 14-inch convex glass to compensate for the paralysis of the accommodation. At the same time he used iron and valerianate of zinc internally, and counter-irritation behind the ears. In July he had made very little progress. I then adopted the system, the rules of which were first laid down by Dr. Ezra Dyer, of Pittsburg, and hence sometimes called "Dyerizing," of working his ciliary muscles by a regular graded series of exercises. After assuring him that he had no disease of the eyes, that they were as good as anyone's, that his whole trouble was attributable to a purely muscular defect, which properly regulated exercise would correct, I impressed upon him the necessity of doing just what I told him and no more. He found he could read *five* minutes without discomfort; ten minutes' reading gave pain. Starting with this time (five minutes), he was told to read regularly three times a day—at first a half hour after breakfast, the second at noon, the third just before sundown, and always with his glasses. The first day, he was to read only five minutes each time; the second, five and a half minutes each time; the third day, six minutes, and so on, increasing one-half minute each day, until he could read ten minutes with comfort. No other use of the eyes was allowed. When he could read ten minutes, he was allowed to increase one minute each day, until he reached thirty minutes three times a day. After that he increased two minutes each day, until one hour and a half was reached. After reaching thirty minutes he varied his exercise by reading or writing during his periods of work, but not exceeding the limit laid down. At times during the exercise, he had some slight discomfort, but it did not last from one period of reading to the next, and he was therefore not obliged to go back and begin over. He also, after the exercise, used a cold douche to the closed lids and rubbed tincture of aconite over the brow. The result was that in October he was enabled to accept a position as teacher of Latin in a prominent school."

The instructions I gave him are almost *verbatim* those of Dr. Dyer, and I have invariably had recourse to them when the correction of the optical defect and proper treatment of any constitutional cause failed to bring about a good result. In the eighty-seven cases enumerated, only two have had little or no result, and I am not sure that these two followed the prescribed treatment.

A careful and systematic examination of the eyes, based upon a complete knowledge of what is required in the visual functions, is absolutely necessary to a clear understanding of such cases; and after correcting any defect in the refraction by proper glasses, and treating any accompanying affection that would have any bearing upon the eye trouble, systematic and regulated use of the eyes should be enjoined.

Very often the apparent state of refraction of the eye is deceptive, as what at first seems to be a myopic eye may be in reality emmetropic or hyperopic; or an apparently emmetropic eye may be, in fact, hyperopic. The true state of refraction may be diagnosed by the use of the ophthalmoscope by those very expert in its use, or by paralyzing the accommodation with atropine, which does away with the element calculated to deceive as to the refraction.

One word more and I will have finished. This is in regard to the common prejudice against the use of glasses and the popular ideas about their being harmful, that they wear out the eyes, &c. Unsuitable glasses of course produce fatigue of the eyes, but suitable glasses once obtained, are most beneficial by doing away with the error of refraction, and this is more especially the case in childhood, when these very errors do most harm to the eye. I always find that the parents object to the child wearing spectacles, and that the friends ridicule the child if he or she does wear them, and this results from the mistaken idea about their doing harm.

Nearsighted children cannot wear glasses too soon, as they frequently arrest the further development of the disease which causes the short sight, and prevent other trouble; and the importance of this fact ought to be impressed upon the parents of such children. But they must not buy glasses at random; they should always go to an ophthalmic surgeon and have the eyes properly examined and the spectacles prescribed, as they go to a physician for any other prescription. Going to an optician's to buy glasses without proper advice, is like going to a druggist's to get medicine for some obscure ailment without consulting the physician. In these days, when errors of refraction are so common, when more than half or three-fourths of the educated classes and their children are victims of these troubles, it is time to do away with the old time prejudices about glasses, and also adopt a rational method of having them properly applied. The slight expense incidental to the latter is more than compensated for by the invariable good that results.